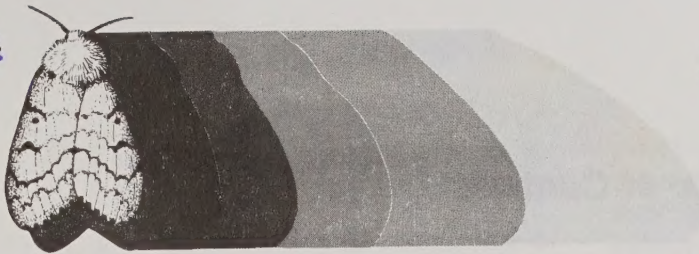


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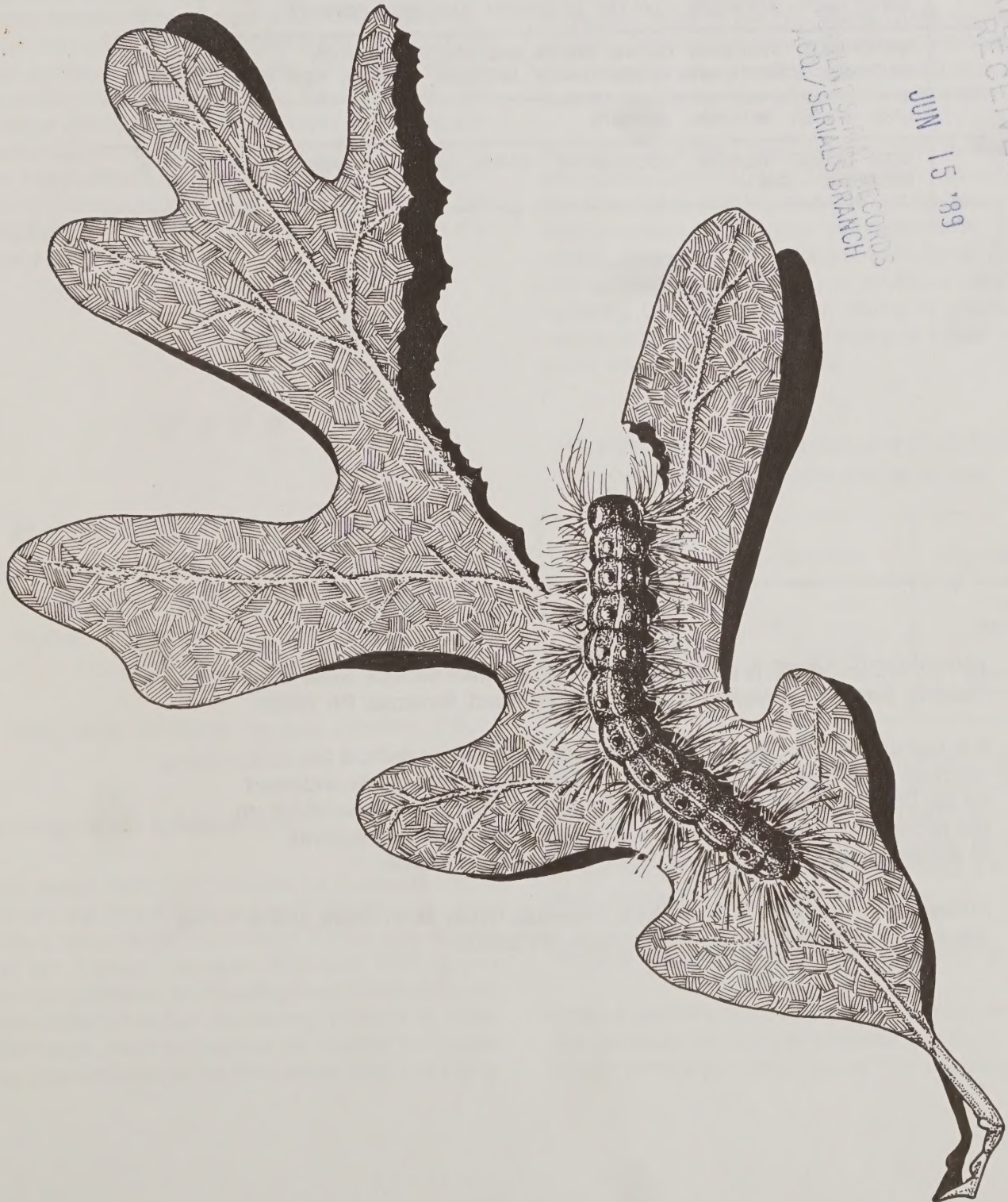


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Address correspondence to Daniel B. Twardus, Gypsy Moth News, USDA Forest Service, 180 Canfield Street, Morgantown, WV 26505.

FROM THE EDITOR

Until recently, the gypsy moth has not posed a threat to very many of the National Forests. This is changing as infestations move south and west into areas containing large National Forests with thousands of acres of susceptible host type. In this issue, the approach to gypsy moth management is reviewed indepth for the Allegheny National Forest in northwest Pennsylvania. This review illustrates the extent of the decisionmaking process a National Forest follows to implement pest management actions. Summaries of gypsy moth management activities are also presented for the White and Green Mountain National Forests in New England, the George Washington National Forest in Virginia, the Nantahala National Forest in North Carolina, and the Huron-Manistee National Forest in Michigan. These Forests represent the leading edge of the National Forest system's ensuing battle with the gypsy moth.

D. Twardus

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MANAGING THE GYPSY MOTH ON THE ALLEGHENY NATIONAL FOREST, PENNSYLVANIA

Robert E. Acciavatti and Robert White
USDA Forest Service, FPM, Morgantown,
WV, and
Allegheny National Forest, Warren, PA,
respectively

Background Information

The gypsy moth has become an important factor influencing forest management activities on portions of the Allegheny National Forest only during the last 5 years. Between 1980 and 1984, gypsy moth populations on the Allegheny National Forest were detected in ever increasing numbers in male-moth traps, but they had not yet reached the densities characteristic of the "first-wave" outbreak along

the defoliating front. The first visible defoliation occurred in 1984 on ca. 2,024 acres of oak type along the Clarion River and Tionesta Creek in the southern portion of the Forest. By 1985, defoliation had increased to ca. 9,642 acres, spread throughout the oak type of the Allegheny River Front along the western portions of the Forest. A suppression project conducted in 1985, and excessive egg mortality attributed to abnormal winter temperature extremes, helped to minimize defoliation. However, the outbreak enlarged over the next 2 years, 78,065 acres in 1986 and 115,640 acres in 1987, thereby subjecting most of the oak forest types on the Allegheny National Forest to at least one, and in about one-third the area, to 2 years of defoliation. The current infestation had all but ended in 1988.

Spraying to protect high value timber, recreation, and wildlife areas began in 1985 using both a chemical insecticide (Dimilin on 9,000 acres) and a biological insecticide (*Bacillus thuringiensis* on 1,500 acres). Since 1985 the Allegheny National Forest has applied only the (*B. t.*) to 37,395 acres. The following table displays the history of moderate/severe defoliation and the history of gypsy moth spray treatment on the Forest.

History of Moderate/Severe Defoliation and Spray Treatment in Acres

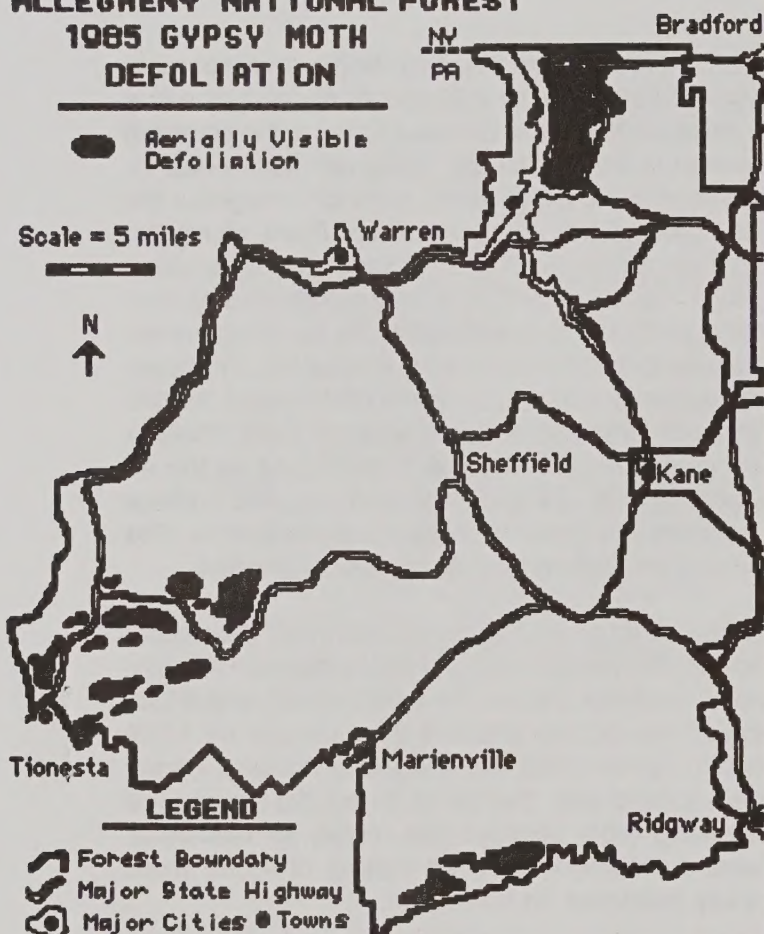
Year	Defoliation	Suppression
1984	2024	0
1985	9642	10500
1986	78065	0
1987	115640	29500
1988	4290	7895

With this rapid population buildup in mind, how did the Allegheny National Forest plan suppression to meet the threat posed by the gypsy moth and what has been the consequences of the gypsy moth outbreak to their forest planning? Let's take a look at their approach and its consequences.

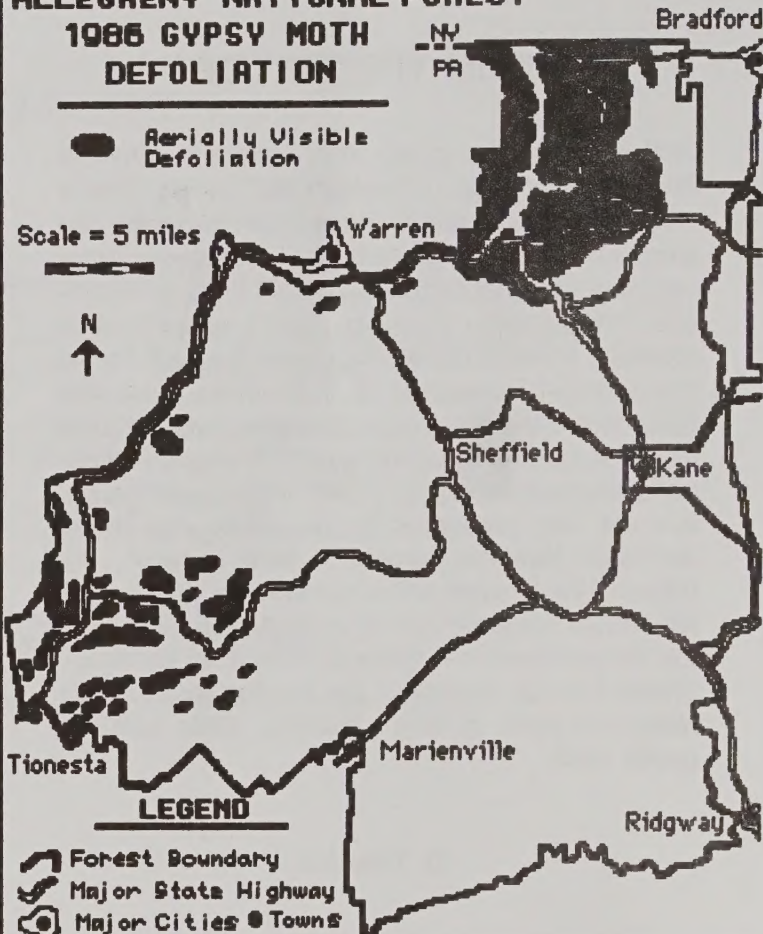
Gypsy Moth Management Planning

Several planning documents (A-F) are pertinent to the questions of when, where and how much of an impact the gypsy moth will have on management of

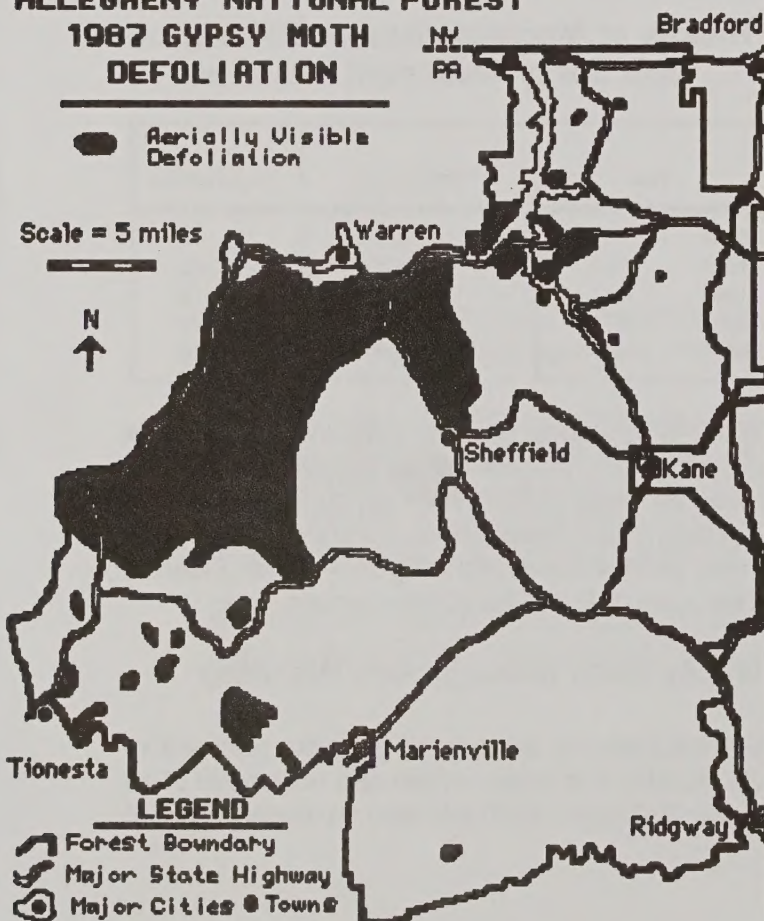
ALLEGHENY NATIONAL FOREST **1985 GYPSY MOTH** **DEFOLIATION**



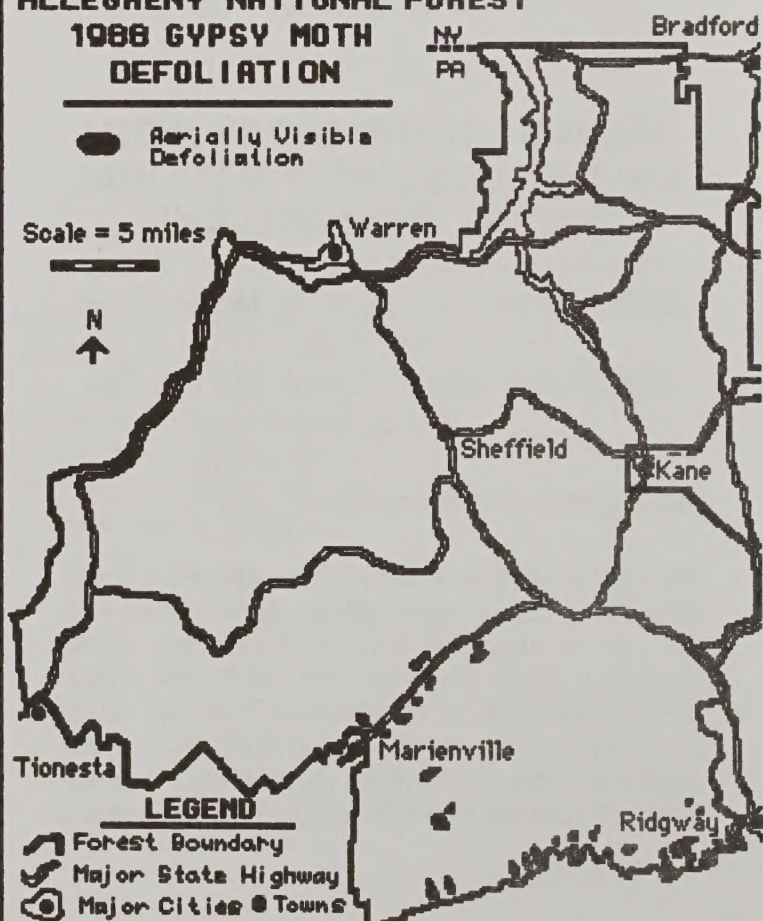
ALLEGHENY NATIONAL FOREST **1986 GYPSY MOTH** **DEFOLIATION**



ALLEGHENY NATIONAL FOREST **1987 GYPSY MOTH** **DEFOLIATION**



ALLEGHENY NATIONAL FOREST **1988 GYPSY MOTH** **DEFOLIATION**



forest resources, what action the Forest will take against the gypsy moth, and how the action will be monitored and evaluated. Each of these will be discussed briefly.

A). Land and Resource Management Plan

The Forest Plan is the document which guides all resource management activities on the Allegheny National Forest. It reflects Regional and Forest direction in its Standards and Guidelines for: 1) the use by Forest personnel of integrated pest management methods to minimize or prevent the development of forest pest problems, such as the gypsy moth; 2) the conduct by FPM of systematic detection, biological evaluations and damage appraisals to assess the current pest situation and predict future trends in resource losses; 3) the preparation, selection and implementation by the Forest Supervisor of prevention or suppression alternatives deemed most efficient, economical and environmentally acceptable for suppressing the pest outbreak; 4) the monitoring and evaluation of prevention and suppression actions by Forest and FPM personnel to quantify performance, document procedures, and compare costs so as to improve on future activities.

B). Biological Evaluation

This document provides information to the Forest Supervisor and District Rangers, the decisionmakers, about the current status of the gypsy moth outbreak throughout the Forest, trends in this status, and the likely consequences of the outbreak on the forest resources in specific areas of the Forest.

Initially, information on timber types were used to locate the susceptible portions of the 510 M acres of Allegheny National Forest. We knew that only about 20 percent of the Forest was comprised of highly susceptible tree species in the Oak Timber Type. The remainder is in the Allegheny Hardwood and Northern Hardwood Type where tree species not very susceptible to the gypsy moth exist. The locations of the Oak Timber Type was readily available from the Forest Plan which was in preparation.

Next, the oak type of ca. 100 M acres was divided into 30 Entomological Areas, each comprised of several timber compartments and, therefore, more or less homogeneous as to administrative control, and physiography. The current outbreak status was determined within each Area by sampling gypsy moth egg mass populations during September and

October of each year. The density of gypsy moth egg masses within each Entomological Area was determined using ca. 15, fixed 1/40-acre plots distributed as uniformly throughout the Area as time, personnel and access would allow.

To determine the outbreak trend, the defoliation caused by the current generation of gypsy moth within an Area was compared with the potential defoliation expected from relationships of mean egg mass density per acre to mean defoliation as recently published by the NEFES, Broomall. Entomological Areas which had experienced moderate to severe defoliation, and those likely to have such defoliation the next spring, were further scrutinized to determine where forest resources were at greatest risk from defoliation and subsequent tree mortality.

The following forest resources were deemed to have the highest risks from the gypsy moth outbreak: high-use developed recreation sites at campgrounds, picnic areas and overlooks; dispersed recreational opportunities along trails and vistas; wildlife habitat improvement areas, such as pruned and released wild apple trees in critical white-tail deer winter range; high-value timber stands commercially thinned or which have received timber stand improvement cuttings within the last 5 years and those scheduled either for thinning or regeneration with the next 5 years. Tentative spray blocks were delineated to include recreational resources, travel and water influence zones, and timber stands, all with a high potential to receive unacceptable loss of use and amounts of damage from stand defoliation and tree mortality.

C). Environmental Impact Statement

An Environmental Impact Statement is required by the National Environmental Policy Act of 1969 and USDA, Forest Service Policy, for all management actions where insecticides are being contemplated for aerial application over National Forest System Lands and where the USDA, Forest Service is cost sharing in such application of State and Private Lands. In 1985, the USDA produced a nationwide EIS entitled, "USDA Gypsy Moth Suppression and Eradication Projects, Final Environmental Impact Statement as Supplemented 1985." The supplementary aspects of this EIS incorporated significant revisions analyzing human health risks from the use of several chemical insecticides registered for use in eradication and suppression of the gypsy moth. For 1986, an addendum has been made to the 1985 EIS

which presents the human health risks in a "plain-language" version. In future years, further addenda may be required to update this EIS with new information on registered insecticides, new insecticides, environmental monitoring, and human health risks.

D). Environmental Assessment

This is the keystone document for suppression decisions by the Forest Supervisor and District Rangers leading to managing gypsy moth outbreaks on the Allegheny National Forest. The EA embodies site-specific information about: 1) the need for action, alternative actions available and their scope; 2) what gypsy moth populations are likely to do to the resources at risk under each alternative; 3) the economic benefits and costs of implementing each alternative; 4) the environmental consequences of each alternative in terms of human health risks, water quality, wildlife habitat, recreational opportunities. Its preparation is required by the National Environmental Policy Act of 1969 and is guided by various USDA, Forest Service national and regional policy and procedural guidelines. Public involvement has a prominent part in the EA from the development of key issues, concerns and opportunities related to the proposed suppression alternatives, through the public comments about the need to make decisions regarding the proposed action preferred by the Allegheny National Forest.

E). Project Proposal, Work and Safety Plans, and Contracting

The USDA, Forest Service, Forest Pest Management Assistant Director, requires specific information about each proposed project involving FPM funds in order to decide if funding is justifiable, and provides an adequate financial return for the expenditure. This helps ensure that available suppression funds are spent where most needed from a national perspective. The Project Proposal and Narrative, prepared by the Forest with input from FPM field offices, provides this information.

Furthermore, for funding to be approved, a proposed project must be perceived as well-organized, adequately supervised, and effectively monitored such that work tasks are identified, responsibilities are assigned, and safety is emphasized. The Project Work and Safety Plan conveys this image and provides this guidance to project personnel.

Development of a contract, along with its advertisement, award and administration, are the responsibilities

of the Forest. The Contracting Officer's Representative has been assigned from the SO Timber Management Staff, with the Inspectors being assigned from the TM or Recreation Staffs at the Ranger District directly involved in the Spray Project. Orientation and training of these personnel for their assignments of keeping spray load records and times, scheduling the sequence of spraying, and spraying only under suitable wind and temperature conditions, are all elements essential to the successful maintenance of spray production at a pace designed to put the insecticide on target when and where required.

Further operational considerations require some discussion. Technical advice from Forest Pest Management to the Forest COR usually involves: 1) inspecting the equipment and ascertaining the qualifications of the successful bidder; 2) calibrating, and characterizing the aircraft spray systems before the project begins, and during it, as needed; 3) determining when insect development presents a target and foliage expansion provides a substrate for optimal spray deposition; 4) monitoring the actual aerial application from a chase aircraft for spray drift, block coverage, shutting off over open bodies of water and on turns; 5) observing weather conditions in the spray blocks; 6) marking with tethered helium-filled balloons spray block boundaries and adjoining critical no-spray areas to avoid; 7) sampling spray deposition onto critical no-spray areas with spray cards.

F). Project Evaluation Report

The final document to be discussed here deals with evaluating the effectiveness of the suppression action in terms of meeting the project objectives set by the Forest. Spray projects typically have objectives within the spray blocks of preventing gypsy moth defoliation from reaching the moderate class (30-60 percent foliage removal), and reducing gypsy moth population densities (at least 90 percent between the treated and next generation). Aerial sketchmapping, or better yet, aerial photography, over the sprayed areas at the time of peak defoliation in nearby unsprayed areas, provides the best evidence for achieving the first objective. Successfully meeting the second objective, on the other hand, involves sampling the change in gypsy moth population densities from the pre- to post-spray generation and is based on a comparison of egg mass densities within and outside of spray blocks in each Entomological Area.

1988 Status of the Infestation

Though gypsy moths are now common across the entire Forest, the population experienced a general collapse following the widespread and severe defoliation which occurred during the spring of 1987. No concentrated areas of noticeable defoliation occurred by the late spring of 1988, but scattered oaks and groups of aspen were moderately defoliated over about 1,500 acres. Spraying with *B. t.* on 7,895 acres this May protected areas having high timber, wildlife, or recreation values where there was the threat of at least moderate defoliation.

Gypsy moth populations typically follow a cycle of 3 to 5 years of buildup followed by a collapse and then 1 to 5 years of lower populations. Populations will then begin to build again, and the cycle begin once more. The collapse occurred here last year, and the next buildup could begin within 2 years, depending on how the gypsy moth responds to local environmental conditions.

Long-term Impacts of the Gypsy Moth of Forest Management

It is anticipated that moderate to heavy gypsy moth defoliation will have several impacts on the Forest's ability to produce Forest Plan outputs. It may affect the ability to retain oak as well as the ability to produce timber volumes. Two to 3 years of heavy defoliation can result in significant tree mortality. First, if oak regeneration is not present, heavy mortality can result in conversion to another forest type. As the Forest Plan was prepared, the public overwhelmingly responded that they wanted the Forest to maintain the oak timber type. Secondly, heavy defoliation and resulting mortality can have a significant effect on timber volume outputs. When thinning occurs within 5 years (before or after) of heavy defoliation, tree mortality may be double that which occurs in an unthinned stand. The Forest Plan called for a large amount of thinning in oak stands which in many cases will have to be deferred. If the tree mortality assessment jointly planned by the Allegheny NF and Forest Pest Management indicates that the most productive oak timber resource was not adequately protected to reduce unacceptable tree mortality, there may need to be adjustments to the Forest Plan timber volume outputs to account for this loss.

Summary

The effectiveness of gypsy moth management on the Allegheny National Forest lies in the development of thorough planning documents which provide a framework for various decisions: 1) decisions which require current information about the gypsy moth status within the Forest and its impacts on specific Forest resources; 2) decisions about the economic benefits derived from various suppression alternatives, and the consequences of each alternative to the environment and human health; 3) decisions relating to the conduct of an efficient and accident-free aerial application of insecticides; 4) decisions concerning changes in management direction and emphasis created by the impacts of gypsy moth related tree mortality on the forest resources and their use.

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GYPSY MOTH ACTIVITIES ON THE SOUTHERN NATIONAL FORESTS

Cindy Huber

USDA Forest Service, FPM, Asheville, NC

Gypsy moth populations and the related suppression/eradication efforts have increased dramatically over the past 2 years in the Forest Service's Region 8. In 1987, the control program consisted of treating 150 acres on the George Washington National Forest to reduce gypsy moth populations to nondamaging levels, and treating approximately 6,000 acres on the Nantahala National Forest to eradicate the gypsy moth from a spot to the south of the generally infested area. In 1988, the program had increased to include suppression treatments on over 9,000 acres of the George Washington National Forest; and two eradication spray projects, each covering over 9,000 acres. All treatments were made using aerially applied pesticides due to limited access and size of the treatment areas.

1987 Treatments and Results

In Virginia, the George Washington National Forest treated 150 acres at the Elizabeth Furnace Campground with a single application of *Bacillus thuringiensis* (*Bt*) using 16 BIUs per acre. No defoliation was observed in 1987 and populations were reduced over most of the treatment area. However, populations in areas adjacent to the treatment block increased and these were treated in 1988.

An eradication project was begun in North Carolina on the Nantahala NF and adjacent private lands in 1987. A total of 5,806 acres of National Forest land were sprayed twice with Dimilin (4,654 acres) or *Bt* (1,152 acres). Trapping results from the 1987 delimiting survey indicated that the treatment was successful, but results also showed that the infested area was larger than the treated, therefore, additional acres were treated in 1988.

1987 Survey Results

All National Forests in Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia and Florida participated in a priority pheromone trapping program which includes recreation and high visitor use areas. In 1987, no moths were trapped on National Forests in Florida and Tennessee. Several Forests reported moth catches for the first time; the Chatahoochee NF in Georgia, the Daniel Boone NF in Kentucky, the Croatan NF in North Carolina and the Francis Marion NF in South Carolina. Trapping has been intensified in these areas in 1988. In North Carolina, the spot infestation on the Nantahala NF persists.

In Virginia, moth catches continued to increase in 1987 on most Districts of the George Washington NF and heavy defoliation was reported on the northern portion of the Lee Ranger District in Shenandoah County. Areas with two years of defoliation show signs of gypsy moth population collapse from an epizootic of nucleopolyhedrosis virus. On the Jefferson NF, which lies to the south of the generally infested area, the 1987 moth catches increased dramatically on the New Castle RD and a spot infesta-

tion was found on the Blacksburg RD and adjacent private lands.

1988 Treatments

Suppression projects on the George Washington NF were conducted in high value recreation areas and general forest areas directly north of the Appalachian Integrated Pest Management project area (see GM News Issue No. 15 for a description of AIPM). A total of 9,185 acres were treated; Dimilin on 5,985 acres, a single application of *Bt* to 2,320 acres and a double application of *Bt* to 1140 acres. The Forest Service, in coordination with the National Park Service, also treated 1,000 acres on the Shenandoah National Park and 847 acres on the National Zoological Park's Conservation Center. Treatments began May 12 and ended May 26.

Eradication treatments were conducted on two National Forests in 1988. The infestation in Giles Co., Va. on the Blacksburg RD was treated with Dimilin and *Bt* between May 7 and 27. The area sprayed consisted of 7,500 acres on the Jefferson NF and 4,100 acres of private land. All acres will be sprayed twice; 8,000 acres with Dimilin and 3,600 acres with *Bt*. Eradication efforts continued in 1988 on the Nantahala NF on National Forest land to the north of the 1987 treatment area. There were 9,119 acres sprayed twice; 8,089 acres with Dimilin and 1,030 acres with *Bt*. Spraying began May 12 and was completed May 27.

1988 Detection Program

Priority trapping continues outside of the generally infested area. Trapping intensity will be increased at sites that reported positive catches in 1987.

The 1988 eradication treatments are being evaluated using delimiting grids of pheromone traps. Results will indicate effectiveness of the 1988 treatments and whether additional follow-up treatments are needed.

National Forests covered by the AIPM boundary are being trapped on a 2 kilometer grid coordinated with the State of Virginia and the National Park Service.

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GYPSY MOTH PROGRAM ON THE GREEN AND WHITE MOUNTAIN NATIONAL FORESTS AND FINGER LAKES NATIONAL FOREST, NEW YORK

Melvyn J. Weiss

USDA Forest Service, Washington, DC,
formerly of Durham, NH

Since gypsy moth populations are very low on both Forests, the USDA Forest Service, FPM, is monitoring the populations in order to give Forest managers enough time to consider alternative management options before the populations reach outbreak levels. The last outbreak on both Forests was in 1982.

When the population declined in 1983, FPM initiated a monitoring program using pheromone-baited traps to detect population buildups. Originally, standard "milk carton" type traps and standard (+) disparlure lures were used to monitor gypsy moth populations. However, since many traps became saturated with male moths before they were recovered from the trap sites, in 1987 (+) disparlures were replaced with racemic disparlures, a weaker lure, and the traps were modified by leaving only two of the eight entry holes open for the male moths to enter in order to reduce moth catch.

There are ten trap sites on the White Mountain National Forest, five on the Green Mountain National Forest (GMNF) and two on the Finger Lakes National Forest (administered under GMNF). All trap sites are located in highly susceptible areas.

Mean moth density/trap on the three National Forests are as follows:

Year	White Mt.	Green Mt.	Finger Lakes
1983	117	538	-
1984	140	481	-
1985	572	1224	-
1986	595	405	-
1987	410	249	265

Presently, no correlation can be made between number of male moths captured in the traps to population densities (egg mass counts/site or acre); therefore, supplementing the traps with burlap bands (for egg masses) is being considered. However, we hope that eventually traps alone will detect gypsy moth problem areas on both Forests as well as the lands of our other Federal cooperators who participate in the program. For now, the relative numbers of the annual moth catch in traps is of considerable value as a source of information for population buildups.

Also, in 1987, the USDA Forest Service, FPM, cooperated with the University of Massachusetts in an attempt to develop a more efficient trap by testing 4 trap types in five compartments on the GMNF. The purpose was to evaluate three alternative ways of reducing moth catch compared to the standard trap and to correlate moth catch to actual population density. The trap types used were:

(1) Two hole traps baited with (+) disparlure release at the standard rate (standard trap).

(2) Two hole traps baited with racemic disparlure at the standard rate.

(3) Two hole traps baited with (+) disparlure released at a vastly reduced rate.

(4) One hole traps, (+) disparlure, standard release rate fitted with a cylinder over the entrance hole to make entry more difficult.

Although moth catch was reduced in the tree non-standard traps, none was completely satisfactory. No correlation could be established between moth catch to actual population density, though the University was reasonably successful in doing this on a state-wide basis.

FPM will continue to monitor gypsy moth population on the Forests. In addition to the trapping activities, FPM began rating individual stands within the five compartments for gypsy moth vulnerability in 1987. FPM is using Herrick and Gansner's method to rank stands so the forest knows which stands would have the greatest tree mortality in the next outbreak. FPM also hopes to continue this work in 1988.

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LAKE STATES NATIONAL FORESTS

Steve Munson

USDA Forest Service, Ogden, UT
formerly of St. Paul, MN

The USDA Forest Service has begun an intensive monitoring program for the gypsy moth on the Tawas Ranger District of the Huron-Manistee National Forest. The purpose of this program is early detection of gypsy moths using a grid monitoring technique and the establishment of pheromone trap plots. The Tawas Ranger District identified six recreation areas as demonstration sites to employ the

concepts of integrated pest management (IPM). The grid monitoring technique is the first stage of the IPM demonstration project. The collection of adult male moths will be used to predict numbers and trends of gypsy moth population levels.

Over 330 green milk carton pheromone traps have been placed in or around the six recreation areas. The information gathered from these traps will then be used to decide when to employ other survey and monitoring parameters (e.g. periodic collection of various life stages, surveys for parasites, invertebrate predator and infectious diseases, and hazard/risk rating). Ultimately, this information will enable the land manager to pre-select the appropriate intervention activity for a given gypsy moth density.

The Huron-Manistee National Forest constitutes new territory for the increasing gypsy moth populations in Michigan's Lower Peninsula. This study will be an example of the feasibility of IPM tactics within a large forested environment. It is hoped that through effective implementation and full evaluation of these demonstration techniques, an alternative approach to coping with the gypsy moth can be found for America's large tracts of forested acreage.

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USDA Forest Service Cooperative Gypsy Moth Suppression Projects - 1988

State or Site	BT	Dimilin	Gypcheck	Total
Delaware	12,910	30,297	0	43,207
Maryland	48,951	116,680	0	165,631
Catocin Mountain Park	2,308	0	0	2,308
C & O Canal	545	0	0	545
Fort Ritchie *	700	0	0	700
Michigan	40,283	0	0	40,283
New Jersey				
Agriculture	11,830	0	0	11,830
Forestry	2,175	0	0	2,175
New York				
Seneca Nation of Indians	2,140	0	0	2,140
Pennsylvania	111,334	106,409	0	217,743
Allegheny National Forest	6,174	0	0	6,174
Gettysburg National Milit. Park	225	0	0	225
Raystown Lake *	700	660	0	1,360
Vermont				
Gypsy Moth Foci Project	550	0	0	550
Virginia	23,837	70,379	0	94,216
Appalachian Trail	0	700	0	700
Arlington National Cemetery	0	501	0	501
George Washington Memorial Parkway	595	0	0	595
George Washington National Forest	4,411	7,323	0	11,734
Manassas National Battlefield Park	125	0	0	125
National Zoological Park	0	847	0	847
Shenandoah National Park	222	600	0	822
Wolfe Trap Farm Park	90	0	0	90
Washington, DC *	4,500	0	0	4,500
Rock Creek Park	793	0	48	841
West Virginia	0	139,124	0	139,124
Harper's Ferry National Historical Park	652	0	0	652
GRAND TOTAL	275,825	473,520	48	749,618

* Partial or no funding from the USDA Forest Service.

Summary of USDA Forest Service, Region 8, eradication projects:

	BT	Dimilin	Gypcheck	Total
Nantahala National Forest	2,150	16,000	0	18,150
Jefferson National Forest	8,370	16,682	0	25,052

Compiled by H. Machesky, USDA Forest Service,
Forest Pest Mgt., Morgantown, WV. July 1988

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